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METHOD FOR TESTING THERMAL STABILITY OF MORTAR MADE WITH HYDRAULIC CEMENT

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "SAFETY AND HEALTH" in Section L of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. SCOPE

This test method determines the thermal stability ratio of cement through compressive strength testing of mortar cube specimens subjected to two different curing conditions. Mortar samples are immersed in water at 50°C for 48 h and companion samples are immersed in water at 23°C for 48 h after initial fog room cure. This test furnishes information helpful in judging the physical and chemical stability of fast setting cements when subjected to elevated temperature and humidity.

B. APPARATUS

1. Cube molds, conforming to the requirements in ASTM Designation C 109/C 109M.
2. Scales and balances shall conform to the requirements of ASTM Designation: C 1005.
3. Glass graduates, of suitable capacities to deliver the indicated volume at 20°C.
4. Mixer, bowl, and paddle, an electrically driven mechanical mixer of the type equipped with paddle and mixing bowl, as specified in ASTM Designation: C 305.
5. Tamper a nonabsorptive, nonabrasive, nonbrittle material such as a rubber

compound having a Shore A durometer hardness of 80 ± 10 . Shall have a cross section of about 13 by 25-mm and a convenient length of 120 to 150 mm. The tamping face shall be flat and at right angles to the length of the tamper.

6. Trowel having a steel blade 100 to 150 mm in length, with straight edges.
7. Moist cabinet or room conforming to the requirements of ASTM Designation: C 511.
8. Testing machine, either the hydraulic or the screw type. The load applied to the test specimen shall be indicated with an accuracy of $\pm 1.0\%$.

C. MATERIALS

1. The hydraulic cement to be evaluated.
2. Graded Ottawa sand conforming to ASTM Designation: C 778.
3. Water, deionized or distilled.

D. TEMPERATURE

The temperature of the air in the vicinity of the mixing area, the dry materials, molds, base plates and mixing bowl shall be maintained between 20 and 25°C. The temperature of the mixing water, moist closet or

moist room, and water in the storage tank shall be set at $23 \pm 1.7^{\circ}\text{C}$.

The temperature of the water in a storage container for elevated temperature curing shall be maintained at $50 \pm 1^{\circ}\text{C}$.

E. PREPARATION OF SPECIMEN MOLDS

The molds shall be coated with a suitable release agent.

F. COMPOSITION OF MORTAR

The proportions of materials for the standard mortar shall be one part cement to 2.75 parts graded sand, by mass. Use a water-cement ratio of 0.5.

The quantities of materials to be mixed at one time for making six test specimens shall be as follows:

Cement	=	500 g
Graded Sand	=	1,375 g
Water	=	250 mL

The volume of water shall be adjusted to compensate for the water content of any chemical admixtures used.

G. PREPARATION OF MORTAR AND TEST SPECIMENS

Mechanically mix the mortar in accordance with the procedure outlined in ASTM Designation: C 305.

Immediately after mixing the mortar, start molding the specimens. Fill each compartment about half way and tamp 32 times in 4 intervals of 8, turn the tamper 90° after each interval. Completely tamp one compartment of the mold before moving to the next. Then slightly over fill the compartment and repeat the tamping process. Finish the surface with the trowel and then strike off any excess with a sawing motion with the blade nearly perpendicular to the top of the mold. Complete the molding process not more than 2 min 30 s after completion of mixing the mortar batch.

H. STORAGE OF TEST SPECIMENS AND CURING

After completion of the molding, place the test specimens, along with the molds, in the moist closet or moist room for 24 h, and then demold the specimens.

Immerse three specimens in water at a temperature of $23 \pm 1.7^{\circ}\text{C}$ for 48 h. Immerse the remaining three specimens in water maintained at a temperature of $50 \pm 1^{\circ}\text{C}$ for 48 h.

I. DETERMINATION OF COMPRESSIVE STRENGTH

Remove the specimens from water and test them under compression. Record the total maximum load indicated by the testing machine.

All test specimens shall be broken at the prescribed age ± 1 h. All specimens from one batch shall be tested within 30 min of each other.

J. CALCULATION

Calculate the compressive strength in Pascals. If the cross-sectional area of a specimen varies more than 1.5 % from the nominal, use the actual area for the calculation of the compressive strength. The compressive strength of all acceptable test specimens made from the same batch and cure conditions, and tested at the same period, shall be averaged and reported to the nearest 50 kPa.

Calculate the thermal stability ratio as the average strength of the mortar cubes cured in water at 50°C divided by the average strength of the mortar cubes cured in water at 23°C and then multiply by 100. Round the answer to the nearest whole number.

K. REPORT

The test report shall include the following information:

1. Type of cement used
2. Cement specimen identification
3. Admixture brand name and dosage rate
4. Type of cure
5. Date of test
6. Age at the time of test
7. Maximum load at failure
8. Average of test specimens broken to nearest 50 kPa
9. Thermal stability ratio

L. SAFETY

Prior to handling, testing or disposing of any waste materials, testers are required to read Part A (Section 5.0), Part B (Sections 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

REFERENCES

ASTM Designations: C 109/C 109M, C 305, C 511,
C 778, and C 1005

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(California Test 553 contains 3 pages)